An Intro to LATEX

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An Intro to
LaTeX

PSAS

What is LaTeX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Things LaTeX is:

- A document preparation system
- A markup language
- Old
- Widely used in academia
- Technically Turing complete
- A way to process, standardize, and automate large, complicated documents
- A way to make professional-quality documents (particularly math)

Things LaTeX isn't:

- A replacement to word processors
- A replacement to hand-written math
- A sane programming language to use
- Something you can easily emulate with other tools

An Intro to
LATEX

PSAS

What is LATEX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

A Minimal Document

```
1  \documentclass{article}
2  \begin{document}
3  Hello, world!
4  \end{document}
```

Hello, world!

An Intro to
LATEX

PSAS

What is LATEX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

Text Syntax

```latex
1  \documentclass{article}
2  \begin{document}
3  Hello, ``world''!
4  This is still part of the first paragraph.
5
6  Blank lines signal new paragraphs.
7  Spaces    only   \emph{separate}    words.
8  % Everything after a '%' is omitted.
9  \end{document}
```

Hello, "world"! This is still part of the first paragraph.
Blank lines signal new paragraphs. Spaces only *separate* words.

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Basic Elements

```latex
1  % this section is the preamble:
2  \documentclass{article}
3  \usepackage{amsmath} % a package
4
5  % this section is the body of the document:
6  \begin{document}
7  The quick brown fox jumps over
8  the lazy dog. % some text
9
10 \LaTeX % a control sequence
11
12 \begin{equation} % an environment
13        1+1=2
14 \end{equation}
15
16 \end{document}
```

An Intro to
LaTeX
PSAS

What is LaTeX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

Math

```
1  \[\frac{2}{2}=1\]
2  \begin{equation}
3          a^2 + b^2 = c^2
4  \end{equation}
5  Remember that $1 \neq 0$.
```

$$\frac{2}{2} = 1$$

$$a^2 + b^2 = c^2 \tag{1}$$

Remember that $1 \neq 0$.

An Intro to
LATEX

PSAS

What is LATEX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

Structure

```
1  \section{Higher Level}\label{sec:high}
2  \subsection{Lower Level}
3  \section*{Labels}
4  This section doesn't have one.
5  \subsection{References}
6  See section \ref{sec:high}.
```

When adding or changing your labels, you must compile [at least] twice, because the counters can depend on how the document is rendered and vice versa.

An Intro to
LATEX

PSAS

What is LATEX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

Titles

```latex
1  \documentclass{article}
2
3  \title{Methods of Grain Alchohol Production}
4  \author{Billy Bob}
5  \date{\today}
6
7  \begin{document}
8  \maketitle
9  ...
10 \end{document}
```

An Intro to
LaTeX

PSAS

What is LaTeX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Table of Contents

```
1  \tableofcontents
```

❶ What is LaTeX

❷ The Basics

❸ Useful Environments

❹ Packages

❺ Floats

❻ Bibliographies

❼ Miscellaneous

❽ Resources

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Useful Environments: lists

```
1  \begin{itemize}
2          \item paper
3          \item water
4          \item fruit
5          \begin{itemize}
6                  \item bananas
7                  \item oranges
8          \end{itemize}
9  \end{itemize}
```

- paper
- water
- fruit
    - bananas
    - oranges

An Intro to
LATEX
PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Useful Environments: align

This requires the amsmath package.

```
1  \begin{align}
2          0 &= \sum_i F_i \\
3          0 &= F_{gravity} + F_1 + F_2
4  \end{align}
```

$$0 = \sum_i F_i \tag{2}$$

$$0 = F_{gravity} + F_1 + F_2 \tag{3}$$

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Useful Environments: verbatim

```
1  \begin{verbatim}
2  \documentclass{article}
3  \begin{document}
4  Hello, world!
5  \end{document}
6  \end{verbatim}
7  Here is some code: \verb+print('Hello, world!')+.
```

```
\documentclass{article}
\begin{document}
Hello, world!
\end{document}

Here is some code: print('Hello, world!').
```

An Intro to
LATEX
PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

How to Use Packages

```latex
1  \documentclass{article}
2
3  \usepackage{amsmath, amssymb}
4  \usepackage{graphicx}
5  \usepackage[letterpaper, margin=1in]{geometry}
6
7  \begin{document}
8  ...
9  \end{document}
```

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments

Packages

Floats
Bibliographies
Miscellaneous
Resources

Useful Packages

`amsmath`	
`amssymb`	really useful stuff for math
`amsfonts`	
`graphicx`	inserting images (including PDFs)
`geometry`	changing the layout of the page
`hyperref`	clickable inter- and extra-document links
`lipsum`	filler text for testing document formatting
`nicefrac`	inline fractions
`siunitx`	easy formatting of units
`fancyvrb`	customized `verbatim` environments
`calc`	allows multiplication of widths

Using `\documentclass[twocolumn]{article}` is also nice.

An Intro to
LATEX

PSAS

What is LATEX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

Figures

Typically, it's best to set [width=\textwidth].

```latex
\begin{figure}
        \centering
        \includegraphics[height=5em]{doge.jpg}
        \caption{A figure.}
        \label{fig:doge}
\end{figure}
```


Figure: A figure.

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Tables

```
1  \begin{table}
2          \centering
3          \caption{A table.}
4          \label{tab:eng}
5          \begin{tabular}{r|l}
6                  Engineering & Awesomeness \\
7                  \hline
8                  Mechanical & 9001 \\
9                  Electrical & 100 \\
10                 Software & 10 \\
11                 Civil & -1 \\
12         \end{tabular}
13 \end{table}
```

Table: A table.

Engineering	Awesomeness
Mechanical	9001
Electrical	100
Software	10
Civil	-1

Notes on Floats

Floats don't usually stay where you put them. LATEXputs them
in the spots of "least badness."
You can use \begin{float}[t] to force the float to the top
of the page. [h] and [b] put it roughly where it is in the
source and at the bottom of the page, respectively.

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Bibliographies and Citations

```
1  It has been shown that you can put really awesome
2  stuff on a rocket \cite{schmidt2015development}.
3  \bibliographystyle{ieeetr}
4  \bibliography{psas.bib}
```

It has been shown that you can put really awesome stuff on a rocket [1].

📄 E. Schmidt, J. Louke, K. Arnell, J. Hickman, and B. Wiles, "Development of a low-cost, open-hardware attitude control system for high-powered rockets," in *AIAA SPACE 2015 Conference and Exposition*, p. 4623, 2015.

An Intro to
LATEX

PSAS

What is LATEX

The Basics

Useful
Environments

Packages

Floats

Bibliographies

Miscellaneous

Resources

Databases

This the TEXinfo format. Google Scholar provides citations in this format, which makes creating bibliographies *much easier!*

```
1   @inproceedings{schmidt2015development,
2       title={Development of a Low-Cost, Open-Hardware
3               Attitude Control System for High-Powered Rockets},
4       author={Schmidt, Erin and Louke, Jeremy and
5               Arnell, Kenneth and Hickman, Jeffrey and Wiles, Brentley},
6       booktitle={AIAA SPACE 2015 Conference and Exposition},
7       pages={4623},
8       year={2015}
9   }
10
11  @incollection{shields2016design,
12      title={Design and Manufacture of an Open-Hardware
13              University Rocket Airframe using Carbon Fiber},
14      author={Shields, Joseph P and Elwood, Leslie},
15      booktitle={AIAA SPACE 2016},
16      pages={5365},
17      year={2016}
18  }
```

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Compiling with Bibliographies

Bibliographies add another layer of linking to your labels and references. You'll have to run an extra command in between renders.

```
1  $ pdflatex hello_world
2  $ bibtex hello_world
3  $ pdflatex hello_world
```

Notes on Bibliographies

There's also the `biblatex` package, which is more powerful
than the default `bibtex`. Note, however, that it uses a
different syntax!

An Intro to
LaTeX
PSAS

What is LaTeX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Misc: special document classes

AIAA provides their own documentclass (as many other journals do) which helps create documents which conform to their standards. They also provide sample documents which demonstrate how to use this documentclass.
https:
//www.aiaa.org/WorkArea/DownloadAsset.aspx?id=4199

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Misc: custom control sequences

You can make shorthand commands for useful things.

```
1  \newcommand{\id}{ \mathrm{d} }
2  \newcommand{\fd}[2]{ \frac{\id #1}{\id #2} }
3  \newcommand{\pd}[2]{ \frac{\partial #1} {\partial #2} }
4  \newcommand{\lag}{ \mathcal{L} }
5
6  \begin{align*}
7  \frac{\partial \mathcal{L}}{\partial q} &=
8          \frac{\mathrm{d}}{\mathrm{d}t}
9          \frac{\partial \mathcal{L}}{\partial \dot q} \\
10
11 \pd{\lag}{q} &= \fd{}{t}\pd{\lag}{\dot q}
12 \end{align*}
```

$$\frac{\partial \mathcal{L}}{\partial q} = \frac{\mathrm{d}}{\mathrm{d}t} \frac{\partial \mathcal{L}}{\partial \dot q}$$

$$\frac{\partial \mathcal{L}}{\partial q} = \frac{\mathrm{d}}{\mathrm{d}t} \frac{\partial \mathcal{L}}{\partial \dot q}$$

An Intro to
LATEX

PSAS

What is LATEX
The Basics
Useful
Environments
Packages
Floats
Bibliographies
Miscellaneous
Resources

Misc: Fudgey Stuff

```
1  \begin{minipage}{\textwidth}
2          % This acts like a self-contained page
3          % of the specified width.
4  \end{minipage}
5  \vfill
6  \vspace{2em}
7  % give a badness rating to not breaking the page:
8  \pagebreak[1000]
```

There are a ton of different preset whitespaces too. Look them up if you need them.

Lengths

em	width of a captial M
ex	width of a lower-case x
in	an inch
cm	a centimeter
\textwidth	current text width
\linewidth	page's line width

Resources

- LaTeXwikibook:
  https://en.wikibooks.org/wiki/LaTeX
  Pretty comprehensive descriptions of everything you will *actually need and use.*

- detexify:
  http://detexify.kirelabs.org/classify.html
  Translates handwritten symbols into LaTeXcontrol sequences, and tells you which package is needed.

- TeXstack exchange: http://tex.stackexchange.com/
  A place where virtually every problem you will have with LaTeXhas already been answered.

- TeX Users Group: https://tug.org/begin.html Old school, highly knowledgeable LaTeX nerds